

CLAIMS

1. A telecommunications rack for connection to an upstream network service provider for providing said service to downstream subscriber equipment also for connection to said rack, comprising:

a plurality of shelves, at least one shelf for connection to said upstream network service provider by means of network termination equipment, each shelf for connection to different equipment of said downstream subscriber equipment by means of line termination equipment, wherein each of said plurality of shelves has a same nonredundant feature;

at least one pair of redundant line termination equipment, one line termination equipment of said pair for use in said at least one shelf in association with said same nonredundant feature thereof and a remaining line termination equipment of said pair for use in another shelf of said plurality of shelves in association with said same nonredundant feature thereof; and

means for connecting said at least one shelf and said another shelf for providing said same nonredundant feature redundantly.

2. The telecommunications rack of claim 1, wherein said same nonredundant feature is a shelf bus for interconnecting said network termination equipment and said line termination equipment.

3. A telecommunications system for connection to an upstream network service provider for providing said service to downstream subscriber equipment, comprising:

a hub (90), including network termination equipment (NT) for connection to said upstream network service provider and including line termination equipment

(14a, ..., 92, 94) connected to said network termination equipment for connection to different equipment of said downstream subscriber equipment; and

5 at least one remote device (96, 98) connected to a line termination equipment (92, 94) of said hub, said remote device including network termination equipment for connection to said line termination equipment of said hub, and also for connection to line termination equipment (ADSL LT) of said remote device, 10 wherein said line termination equipment of said remote device is for connection to said subscriber equipment by a plurality of twisted pairs.

4. The telecommunications system of claim 3, wherein said line termination equipment (14a) of said hub 15 includes line termination equipment for direct connection to subscriber premises by means of twisted pairs (116).

5. The telecommunications system of claim 3, wherein said network termination equipment of said at least one remote device is connected to aggregate line 20 termination equipment of said hub corresponding to a transport mechanism used to interconnect said hub with said remote device.

6. The telecommunications system of claim 3, wherein said hub accommodates said line termination 25 equipment as line termination cards for direct connection to subscriber premises and at least one aggregate line termination card for connection to said at least one remote device, wherein service classes in both cases are provided for subscribers by separate buffers per service 30 class, each contending for upstream access to a hub bus for interconnecting said line termination equipment and said network termination equipment, wherein the service

class buffers for said at least one aggregate line termination card have a cell priority equal to a sum of the aggregate cell priorities in each buffer or some percentage thereof, in order that subscriber premises connected to said at least one remote device are assigned a fair share of an operating bandwidth of the hub.

7. The telecommunications system of claim 3, wherein said line termination equipment (14a, ..., 92, 94, ..., ADSL LT) includes buffers segregated by service class, wherein upstream packets or cells from said subscriber equipment contend for upstream access to a bus (IQ) interconnecting said line termination equipment to said network termination equipment, wherein said access is granted based on a priority assigned to each packet or upstream cell.

8. The telecommunications system of claim 7, wherein said priority is a weighted priority based on a service class associated with said packet or cell.

9. The telecommunications system of claim 8, wherein said priority is also based on an aging mechanism.

10. The system of claim 3, wherein said at least one remote device is connected to said hub redundantly.

11. The system of claim 10, wherein said at least one remote device is connected to said hub redundantly by means of connections to two separate shelves of said hub and wherein said hub comprises a rack of shelves.

12. A telecommunications rack for connection to an upstream network service provider for providing said

service to downstream subscriber equipment also for connection to said rack, comprising:

5 a plurality of shelves, at least one shelf for connection to said upstream network service provider by means of network termination equipment, each shelf for connection to different equipment of said downstream subscriber equipment by means of line termination equipment, wherein each of said plurality of shelves has a same nonredundant shelf bus for interconnecting said network termination equipment and said line termination equipment; and

10 a plurality of extender cards for use in all of said plurality of shelves, except one shelf in which said network termination equipment is used, wherein said extender cards substitute for said network termination equipment in each of said shelves except said one shelf having said network termination equipment, wherein said network termination equipment in said one shelf interconnects all of said line termination equipment in said rack to said upstream network service provider.

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25 13. A telecommunications shelf for mounting in a telecommunications rack of a telecommunications system for providing network services from an upstream network service provider to downstream subscriber equipment, comprising:

network termination equipment, for connection to said upstream network service provider;

a backplane bus;

30 at least one pair of redundant line termination equipment for connection to said network termination equipment via said backplane bus and for connection to said downstream subscriber equipment.

14. A telecommunication system, comprising:

5 a plurality of telecommunication racks, each  
rack capable of housing a plurality of shelves, at least  
one shelf of one rack for connection to an upstream  
broadband network service provider by means of network  
10 termination equipment, each shelf for housing line  
termination equipment for connecting plural twisted  
copper pairs to subscriber equipment at corresponding  
plural subscriber premises for delivery of broadband  
services, wherein said line termination equipment  
15 occupies a space six rack spaces in height for containing  
up to twelve line termination cards in a central portion  
of said shelf, and wherein said network termination  
equipment includes at least one network termination card  
also occupying six rack spaces in height adjacent said  
line termination equipment but at an end of said shelf.

20 15. The system of claim 14, wherein each shelf  
further comprises lowpass filter equipment for connection  
to a central office switch, to said twisted copper pairs  
and to said line termination equipment, for delivery of  
narrowband services to said plural subscriber premises,  
said low pass filter equipment occupying a central  
portion of said shelf having a height of three rack  
spaces for containing up to twelve lowpass filter cards  
with four lowpass filters each for connection to four  
25 twisted copper pairs.

16. The system of claim 14, wherein each shelf is  
nine rack spaces in height and each rack can house up to  
four shelves.

30 17. The system of claim 14, wherein said system  
comprises three racks capable of housing up to four  
shelves each.

18. The system of claim 17, wherein each shelf is capable of connection to up to forty-eight twisted copper pairs, and therefore each rack is for connection to up to one hundred ninety-two twisted copper pairs, and therefore three interconnected racks are for connection to up to five hundred seventy-six twisted copper pairs.

19. The system of claim 14, wherein each shelf is four hundred ninety-eight millimeters wide and two hundred eighty-five millimeters deep.

20. The system of claim 14, wherein each shelf is front access only.

21. The shelf of claim 14, wherein each shelf has a one-hundred fifty-five to six hundred twenty-two Mb/s backplane data bus.

22. The system of claim 14, wherein shelf includes lowpass passive filtering equipment separate from said line termination equipment.

23. The system of claim 22, wherein said line termination equipment and lowpass passive filtering equipment are embodied as separate printed circuit boards.

24. The system of claim 23, wherein four twisted copper pairs are associated with each associated pair of a line termination card and a lowpass filter card.

25. The system of claim 14, wherein each shelf includes a backplane bus to which priority access is adaptable after each of a plurality of grant cycles, so that various subscriber terminals with respective

priority values assigned thereto has its priority increased after a period of inability to gain upstream access.

5           26. The system of claim 14, wherein said network termination equipment includes a pair of redundant network termination cards with automatic protection switching and physically located adjacent each other at said end of said shelf.

10           27. The system of claim 14, further comprising an alarm collection unit located at an end of said shelf.

15           28. The system of claim 14, wherein each shelf further comprises an optional network element processor (NEP) for terminating signaling channels for switched virtual connection services or permanent virtual connection services.

20           29. The system of claim 14, further comprising a network element processor for terminating an ethernet port.

25           30. A system, comprising:  
            a central office (100) including an asynchronous transfer mode (ATM) switch (104) connected to an ATM network (108), a central office switch (102) connected to a public switched telephone network (106) and a hub (90) connected to both said ATM switch and to said central office switch;  
            subscriber equipment located at separate customer premises 118, each including both a digital subscriber line (DSL) modem (126) and a plain old telephone service (POTS) terminal (124) connected to said hub by a corresponding twisted copper pair, wherein both

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POTS and DSL services are provided on a plurality of separate twisted copper pairs to said separate customer premises.

5 31. The system of claim 30, further comprising remote equipment (96) connected to said hub (90), said remote equipment for serving multiple customer premises with both POTS and DSL services.

10 32. The telecommunications rack of claim 12, wherein said plurality of extender cards includes redundant extender cards for use in each of said plurality of shelves, wherein said network termination equipment includes redundant network termination cards in said one shelf having said network termination equipment, wherein a failure of a network termination card or  
15 extender card causes bank switching of all line termination cards from an active network termination extender string to a backup network termination extender string.

20 33. A digital loop carrier (DLC) housing, comprising:

a DLC remote terminal for providing plain old telephone service (POTS);

a splitter shelf having a plurality of lowpass filters (LPPFs) for providing said POTS to a connector;

25 a shelf including a network termination (NT) card for connection to a broadband switch, said NT card connected to a line termination card having a highpass filter for connection to said connector of said splitter shelf, wherein said connector is for connection to  
30 subscriber premises by means of a twisted copper pair.



34. The DLC housing of claim 33, wherein said shelf has space for both line termination cards, network termination cards and lowpass filter cards in case said splitter shelf is not used and said POTS is connected directly to said shelf.

35. A cabinet for use remotely from a central office for use in providing both broadband services and narrowband services to subscriber premises, comprising:

a backplane bus;

a network termination card connected to said backplane bus; and

a plurality of line termination cards connected to said backplane bus as well as to a plurality of lowpass filter cards also connected to said backplane bus and to customer premises equipment for providing both said broadband services via said line termination cards and said narrowband services via said lowpass filter cards, wherein said lowpass filter cards are connected to a central office and wherein said line termination cards are connected to a broadband network via said backplane bus and via said network termination card.

36. The cabinet of claim 35, wherein said line termination cards comprise six line termination cards and wherein said lowpass filter cards comprise six lowpass filter cards.

37. The cabinet of claim 35, wherein said line termination cards are twenty-four in number and said lowpass filter cards are twenty-four in number.